RESEARCH ARTICLE **(Open Access)**

Age composition and growth parameters of bleak (*Alburnus alburnus alborella*) population in Shkodra Lake

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Abstract:

Bleak (*Alburnus alburnus alborella*, de Filippi, 1844) is an endemic species and one of the most important commercial species of Shkodra Lake. Its catch makes 60-70% of the Lake's total production. The study aimed to investigate the population status of bleak in the Albanian part of Shkodra Lake by using some biological factors as age composition and sizes, condition factor, growth parameters, growth performance and mortality. The samplings were made by catch. The total length data were composed together as a single time collection and grouped into 1 cm length classes. The growth curve for bleak population was estimated from the relative position of the modes in a single length frequency sample. The von Bertalanffy growth parameters for bleak population were estimated as $K=0.42\ yr^{-1}$; $L_\infty=27.5$ cm; $t_0=0.00$ yr. Based on growth and mortality data of the population, some considerations on fishing effort are presented in order to ensure the sustainable exploitation of the reserve.

Keywords: bleak, growth parameters, mortality.

1. Introduction

The ichthyological studies carried out by Albanian and Montenegrin researches show that the Shkodra Lake has 56 fish species belonging to 17 families [2]. There are more than ten fish species of some management relevance in the Lake. The major species in the catches are bleak, common carp, and eel. The bleak catches make 60-70% (OMP, Shkodra Lake, 2011) of the total lake catches. Bleak spawns in April-May. It is a pelagic species, mainly feeding on zooplankton. Bleak is caught by gill nets and beach seine during the winter months. Based on the Specific Regulation (No 1, 29.03.2005) for implementation of the law No 7908, "For fishing and aquaculture" the minimum catch size for bleak should not be under 10 cm TL, and the minimal mesh size (knot to knot) should be 14 cm. The closed season for bleak in Shkrodra Lake is from April, 1st to July, 31. Regardless of some work on biological, and more especially on morphological and morfometrical characteristics and systematics of bleak [13, 6, 2, 1] and some considerations given by Rakaj, Kolaneci et al. and Memia [13, 5, 7] on the growth characteristics and stock size, there is a lack of the data on bleak populations in the albanian side of Lake Shkodra in the recent years. This study is an attempt to estimate the age composition, growth parameters and mortalities as well as the exploitation rate of bleak (*Alburnus alburnus alborella*; de Filippi, 1844) populations in Lake Shkodra, using length frequency analysis and length at age relationship. The data on populations' growth and mortality are essential for estimating stock size and its variation, and providing sustainable exploitation of the reserve.

2. Material and Methods

Fish samplings took place on three stations in Koplik, Shiroka and Zogaj, the main area of local commercial fishery, in January and February 2012. Monthly samples were composed together as a single time collection. Fish were caught with nets having mesh size 15 mm and 22 mm. Given the short duration of the sampling period, no allowance was made for fish growth during this period. The total length (TL) of each specimen was measured to the nearest 0.1 cm and grouped in 1 cm length classes. The Fish Stock Assessment Tool [3] software was used to analyze the monthly length frequency data. The ELEFAN I procedure was used to sequentially arrange the monthly length frequency data, from which a preliminary L_∞ was evaluated. The procedure was then used to fit the von Bertalanffy growth function (VBGF) using the equation proposed by Pauly et al. [10]. The growth performance index was calculated as $Ø' = \log K + 2\log L_\infty$ [8]. Based on the calculated growth data of bleak, the length frequency

distributions are converted to age frequency distributions by means of the length converted catch curves [11, 14]. The mortality rates were estimated through catch functions. The approximate natural mortality of bleak populations was estimated based on Pauly's empirical formula [12] For estimation of total mortality (Z), the length converted catch curve was used [4]. Based on the values of K and L_∞ the length converted catch curve was built, the slope of which with the sign changed, gave an estimate of total mortality. Fishing mortality was estimated by subtraction F=Z-M. One common cause of bias in length-frequency data is the selectivity of the gear(s) used to obtain the samples. This bias can be in part overcome by correcting size frequency samples with the probabilities of capture. Probabilities of captures was calculated according to Pauly and Soriano [9] and Gaynilo [4].

3. Results and Discussion

Our study related to a total 1080 specimens of sizes ranging between 6.5 cm (1 individual) and 19.7 cm TL (1 individual). The growth parameters, obtained from length frequency distribution data which then were converted to age frequency distribution and used for the growth parameters calculation using non-linear least squares method (K=0.53±0.12 yr^{-1}, L_∞=19.42±1.01 cm, t_0=0.0) (Figure 1), are comparable with that find by Kolaneci et al. [5] for the same population using the same methods (K=0.52 yr^{-1}, L_∞=20.0 cm and t_0=-0.03 yr) two years before. The growth coefficient estimated in these two recent studies is higher than that reported by Memia [7] for the same fish population inhabit Shkodra Lake (K=0.32 yr^{-1}).

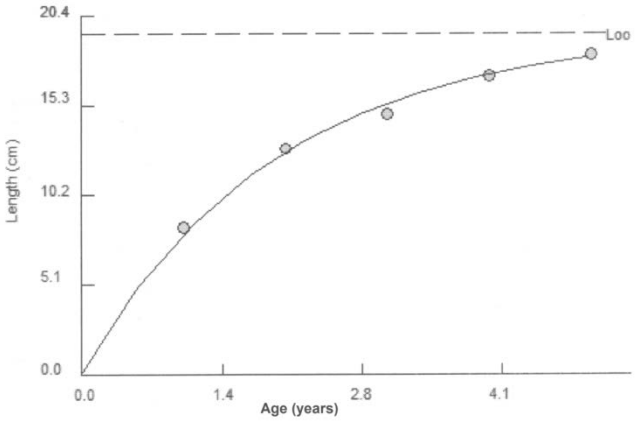

Figure 1. Von Bertalanffy growth curve of bleak population in Shkodra lake (K=0.53 yr^{-1}, L_∞=19.42 cm, t_0=0.0)

The curve was superimposed over the length frequency histograms (Figure 2). The growth parameters obtained from ELEFAN I procedure were K=0.42 yr^{-1}, L_∞=27.5 cm.

The growth performance index (Ø') was calculated as 2.51 (for K=0.42 yr^{-1}, L_∞=27.5 cm TL).

From the length converted catch curve (Figure 3) total mortality rate (Z) was estimated 3.94 yr^{-1} and natural mortality rate (M) was calculated as 0.85 yr^{-1}. Fishing mortality rate (F) was calculated as 3.10 yr^{-1}. The level of exploitation (E) rate has been assessed as 0.79 yr^{-1}. Compared with the total mortality rate reported by Memia [7] (Z=1.7 yr^{-}) this study confirm a higher total mortality rate that comes from the high fishing mortality (F= 3.10 yr^{-}). High fishing mortality rate of bleak population in the lake must be a consequence of illegal fishing gear (light fishing and fishing with illegal mash sizes). These fishing techniques have brought considerable damage to the stock which needs some time to recover.

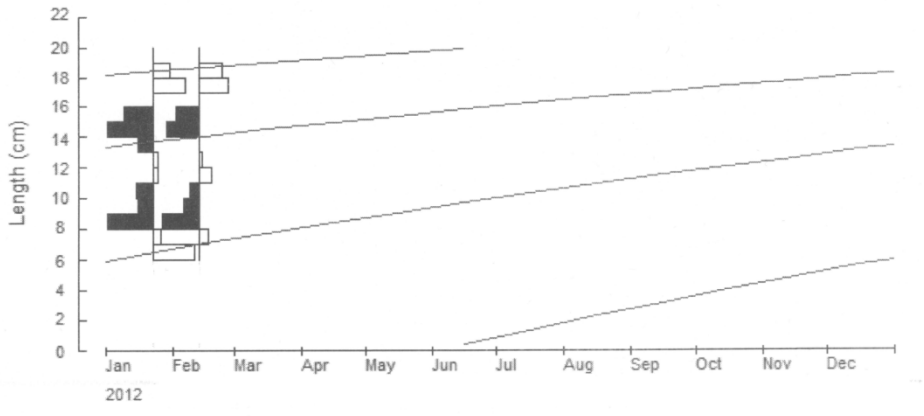

Figure 2. Von Bertalanffy growth function plot and length frequencies (K=0.42 yr^{-1}, L_∞=27.5 cm (TL)). (January: 545 individuals; Februaray: 535 individuals).

The catch curve for bleak population (Figure 3) consists of the regression fitted through the descending data points. The initial ascending data points are not included in the regression, because they represent younger age groups, which are subjected to a lower fishing mortality since they are either not fully recruited or are not fully vulnerable to the fishing gear used (age under 1.78 years and length under 14.5 cm (mid-value of the length class). The relative age of fish more vulnerable to fishing gear used lie between 1.78 - 2.94 year and between the length 14.5 – 19.5 cm. The extrapolated points in Figure 4 can be used to approximate the probability of capture (Figure 5).

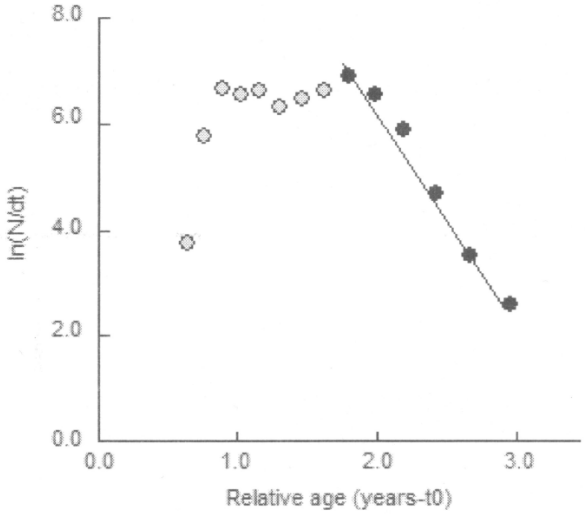

Figure 3. Length converted catch curve (b=-3.94)

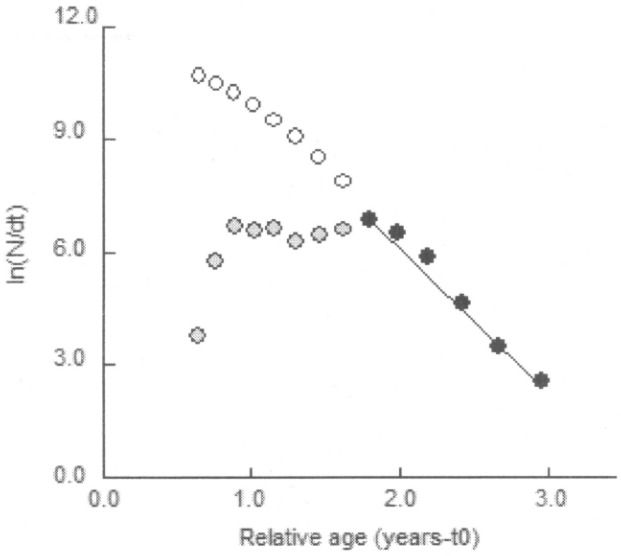

Figure 4. Length converted catch curve (Z=3.94 yr^{-1}.; M (at 18^0C)=0.85 yr^{-1}, F=3.10 yr^{-1}; E=0.79)

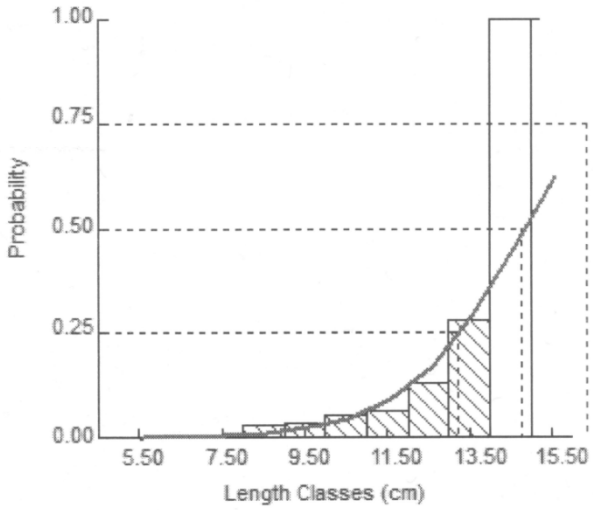

Figure 5. Probability of capture.

The total length (TL) of the fish corresponding to the three levels of probability L-0.25, L-0.50 and L-0.75 are 13.22 cm, 14.79 cm and 16.37 cm. Thus, fishes with TL higher than 16.37 cm have a probability higher than 0.75 to be caught.

4. Conclusions

It is urgent to take measurements to decrease the fishing mortality rate of bleak population in the Lake. Any increase of mortality rate, such as through the development of a direct fishery, would seriously compromise the survival of the population. For that reason fishery managing plans for the Lake Shkodra must be enforced for a sustainable exploitation of the stock. Beside this, further studies are needed on the habitat destruction, pollution, and population characteristics of plankton in Shkodra Lake that will provide the needed information for the better explanation of the biological characteristics of bleak populations.

6. References

1. Dhora Dh, Smajlaj Rr, Dhora A: **Katalogu i peshqve të ujrave të brendshëm të Shqipërisë.** Bul. Shk., Ser. Shk. Nat. 2008, **58**: 100-130.
2. Dhora Dh: **Liqeni i Shkodrës, CP Peshqit** 2005, 126-141.
3. FiSAT II **(FAO-ICLARM Stock Assessment Tools), Version 1.2.2.**: 2005.
4. Gayanilo F C, Sparre P, Pauly D: **FAO-ICLARM Stock Assessment Tools II, Users Guide,** 2002, FAO, Roma.
5. Kolaneci V, Shegani Ç, Nikolla M, Kuka B: **Some biological properties of two cyprinid fishes living in Skadar Lake**. In: Conference

on Water Observation and Information System for Decision Support (BALWOIS): 2010, May 25-29, 2010, Ohrid, Macedonia.

6. Kristo R: **List of freshwater, brackish and marine fishes of Albania**. 2001: www.fishbase.org/
7. Memia SH: **Studimi i dinamikes se popullatave dhe te shfrytezimit te gjuces ne liqenet e Shkodres dhe te Fierzes**. Dizertacion, Universiteti Bujqesor i Tiranes, Tirane, Shqiperi. 1987.
8. Pauly D and Munro J L: **Once more on the comparison of growth in fish and invertebrates**. ICLARM Fishbyte, 1984, **2**(1): 21.
9. Pauly D and Soriano M L: **Some practical extensions to Beverton and Holt's relative yield-per-recruit model**. In: Maclean J L, Dizon LB and Hosillo LV (eds.). The First Asian Fisheries Forum. Asian Fisheries Society, 1986: 491-496, Manila, Philippines.
10. Pauly D, Soriano-Bartz M, Moreau J and Jarre A: **A new model accounting for seasonal cessation of growth in fishes.** Austr. J. Mar. Freshwat. Res.: 1992, **43**:1151-1156.
11. Pauly D: **Some simple methods for the assessment of tropical fish stocks**. FAO Fisheries Technical Paper 1983: **234**.
12. Pauly D: **On the interrelationships between natural mortality, growth parameters, and mean environmental temperature in 175 fish stocks**. Journal du Conseil, Conseil International pour l'Exploration de la Mer. 1980: **39**, 175-192.
13. Rakaj N: **Iktiofauna e Shqipërisë**. Shtëpia Botuese e Librit Universitar, 1995: Tiranë.
14. Sparre P, Ursin E, Venema C S: **Introduction to tropical fish stock assessment. Part I – Manual.** FAO Fisheries Technical Paper. 1989: **306.1.**